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Bosses

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(54) **EXTRACTOR INCLUDING SONIC AGITATOR**

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A47L 9/04 (2006.01)

(52) **U.S. Cl.** **15/320**; 15/364

(58) **Field of Classification Search** 15/320, 15/321, 322, 363, 364, 382, 383, 384
See application file for complete search history.

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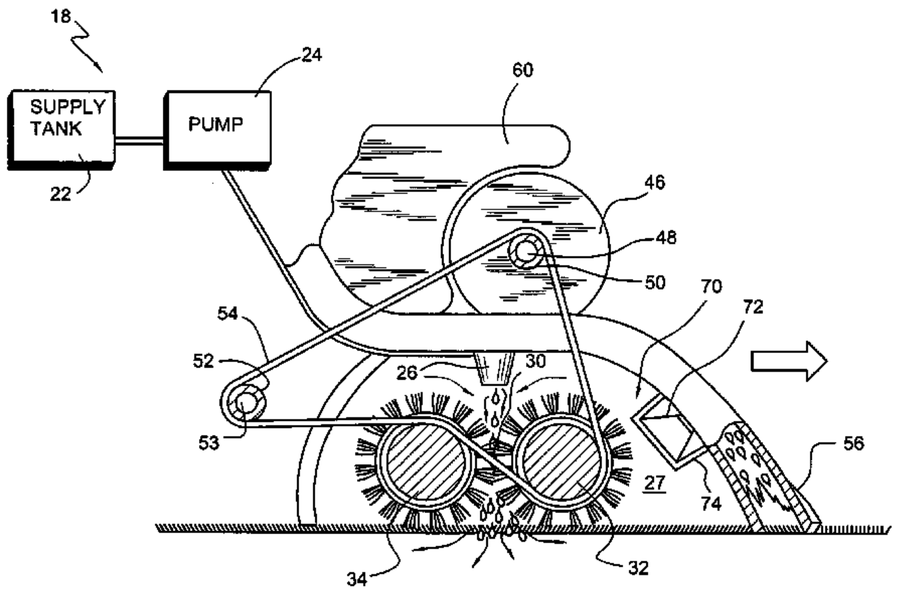
(57) **ABSTRACT**

A carpet extractor head for a carpet extractor including at least one sonic agitator.

17 Claims, 8 Drawing Sheets



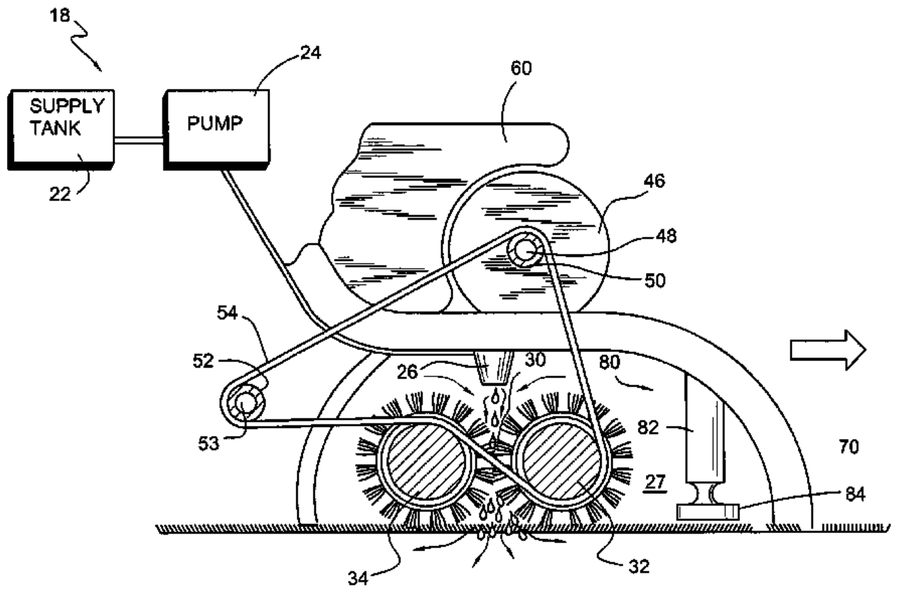


FIG. 1

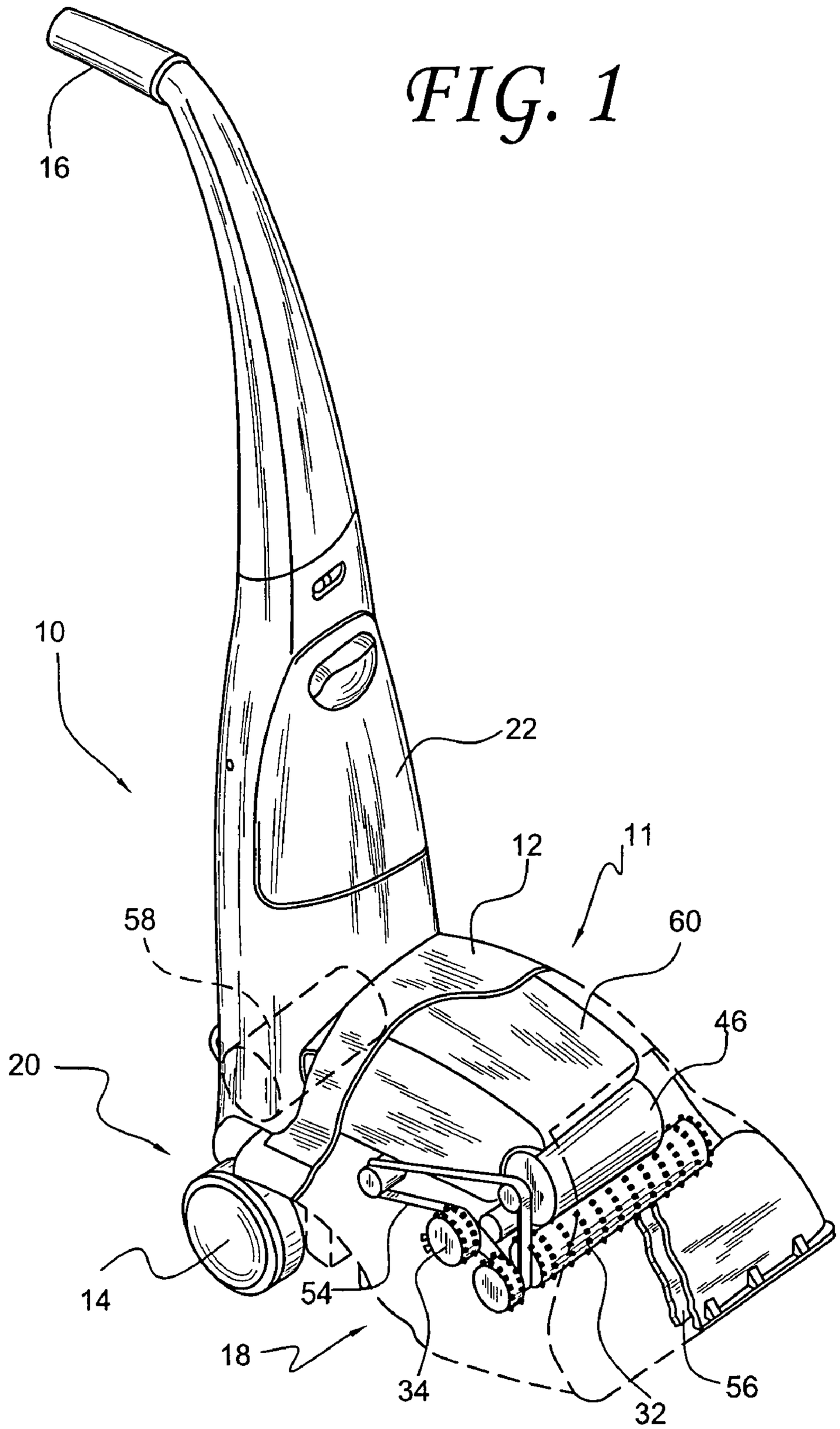
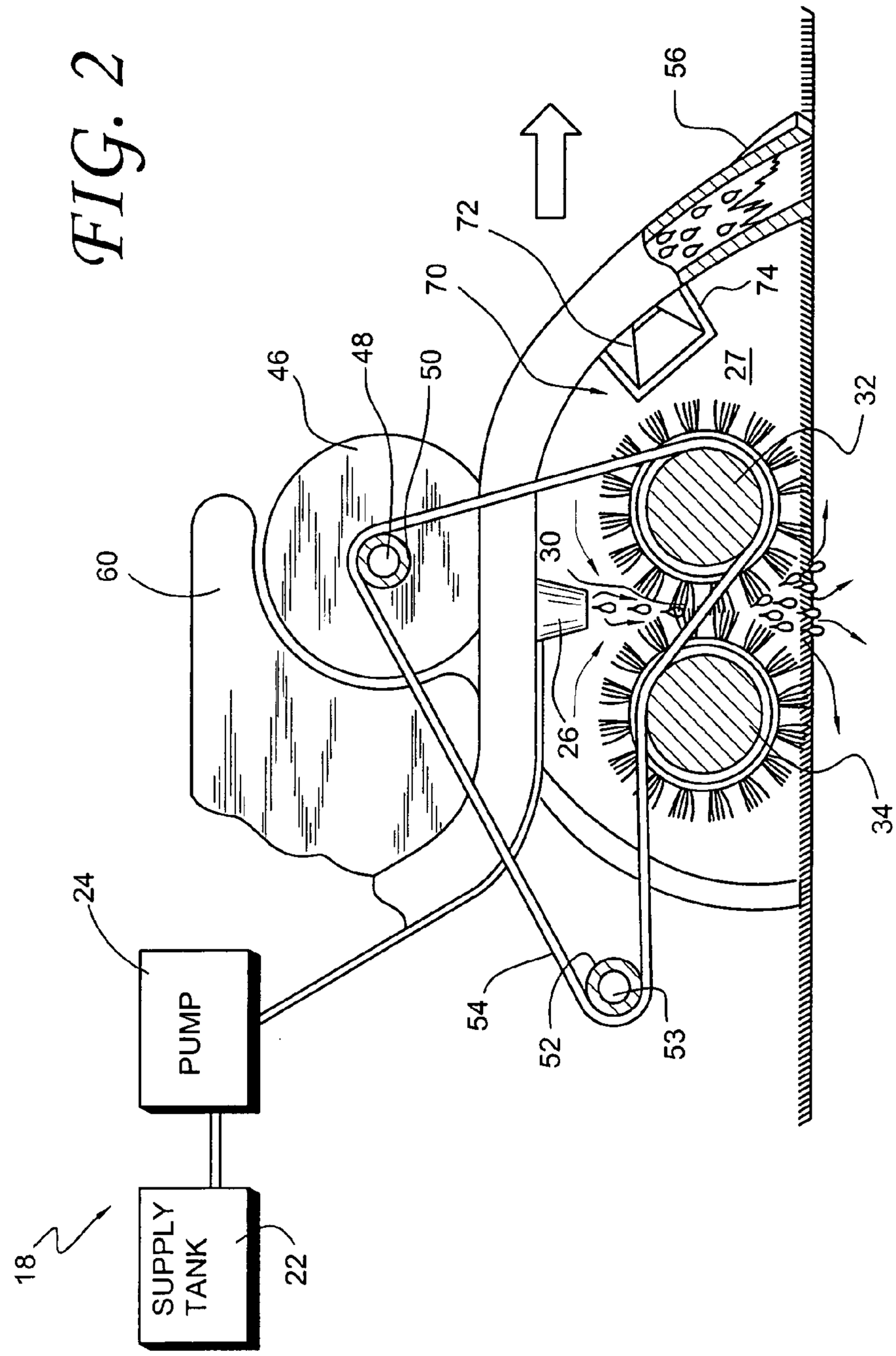


FIG. 2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72
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74
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46
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SUPPLY TANK
18
22

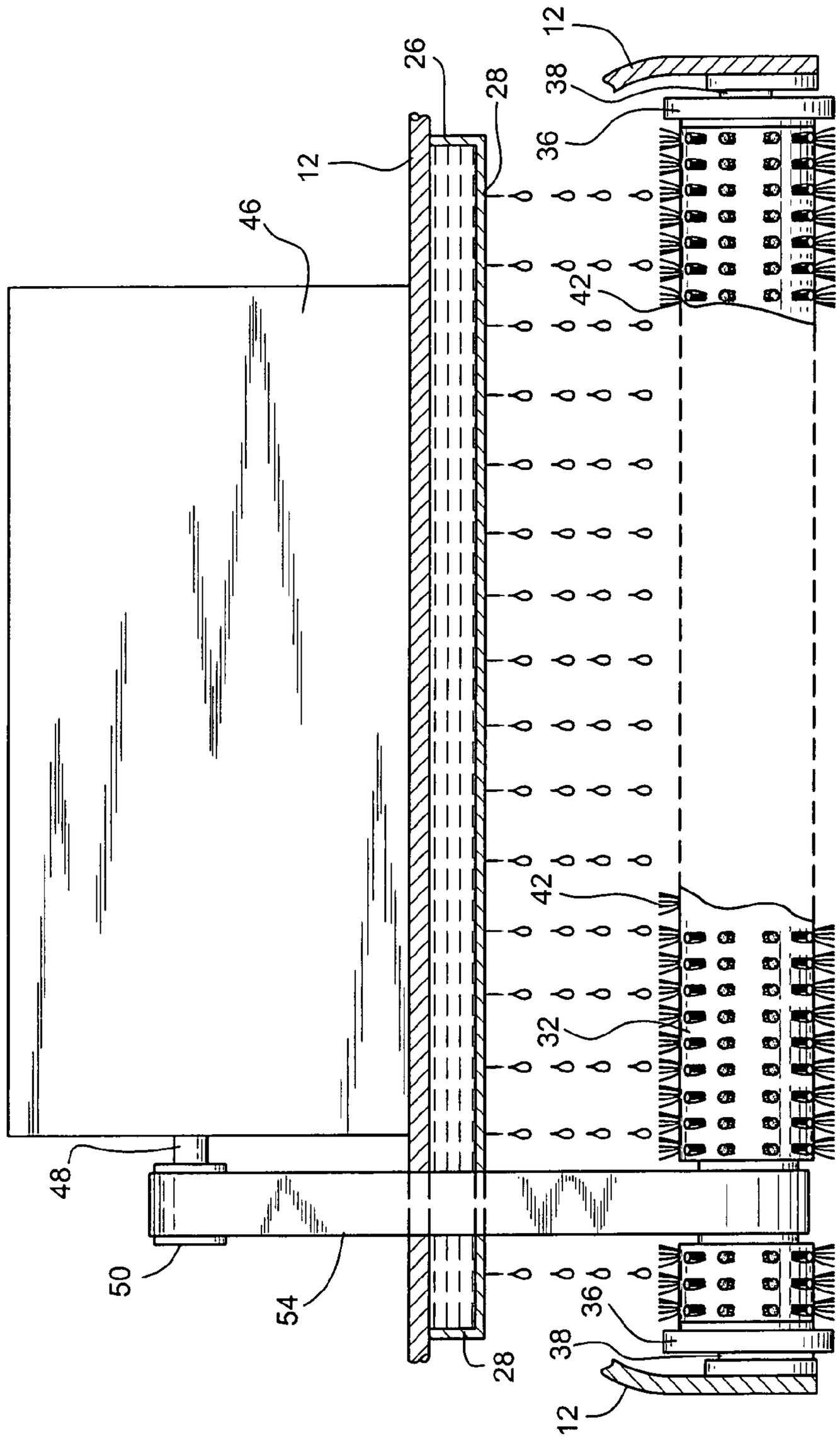
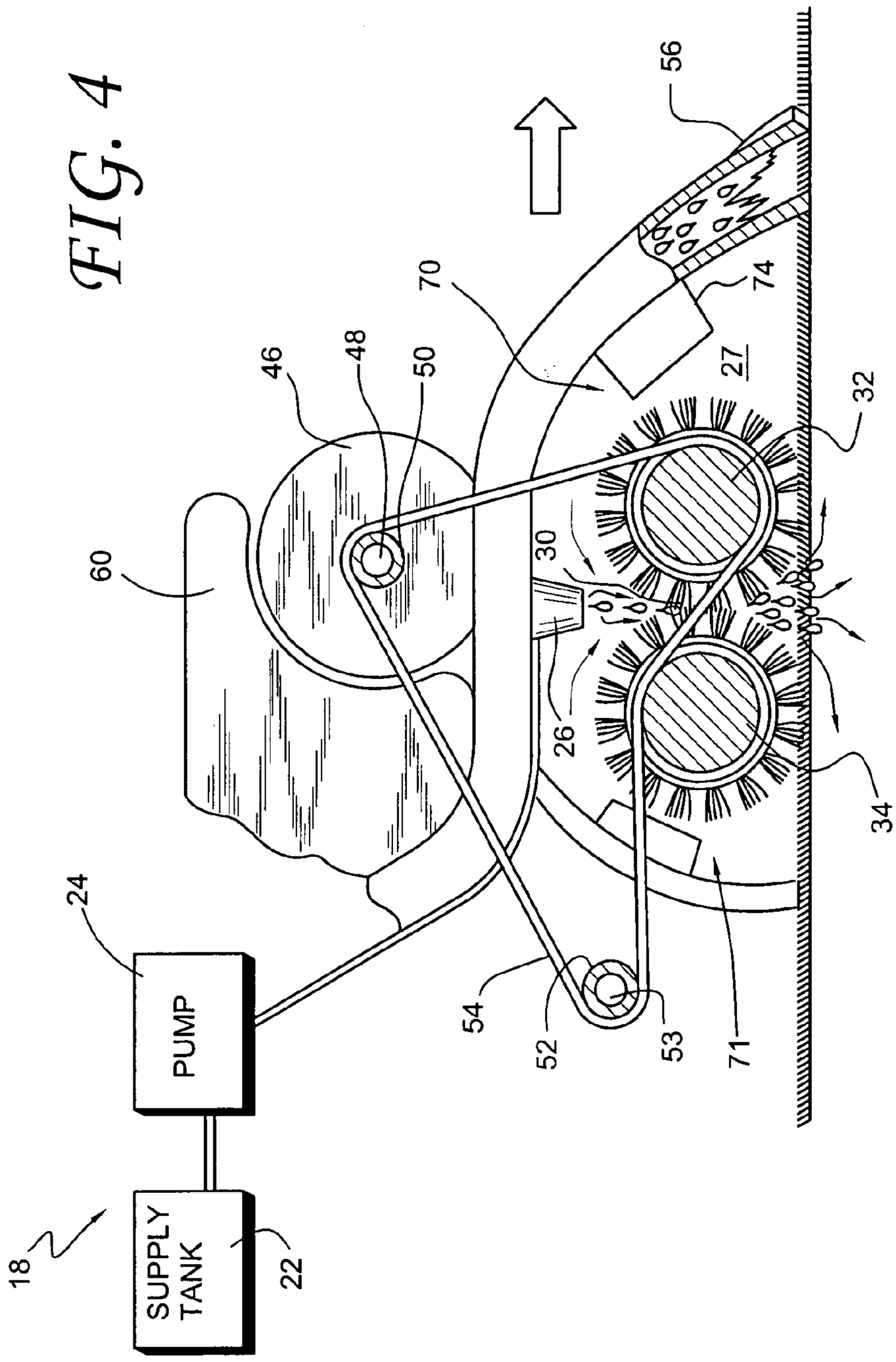


FIG. 3

FIG. 4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70
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46
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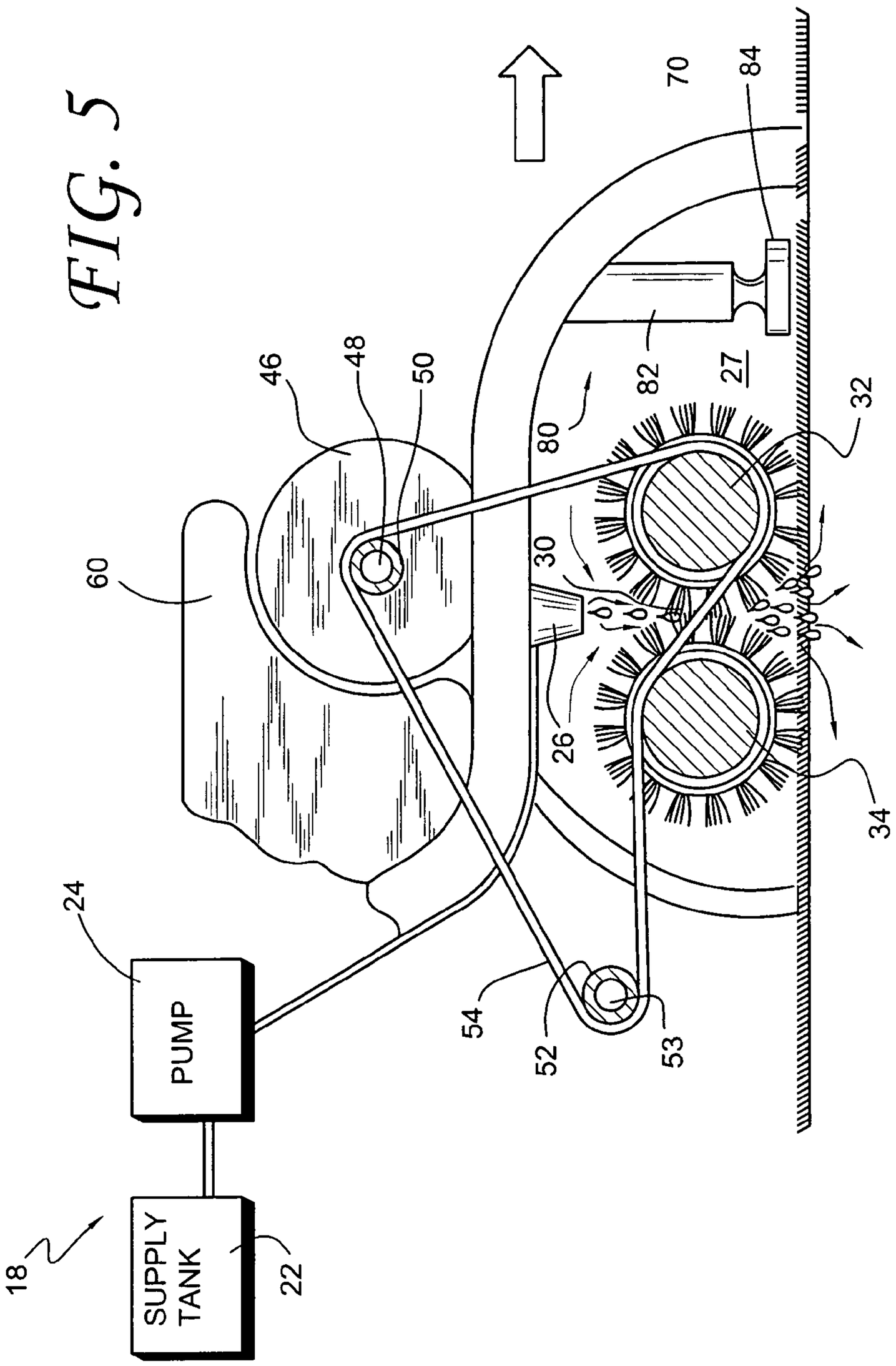
22

FIG. 5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84
46
48
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82
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26
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PUMP
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SUPPLY TANK
22

FIG. 6

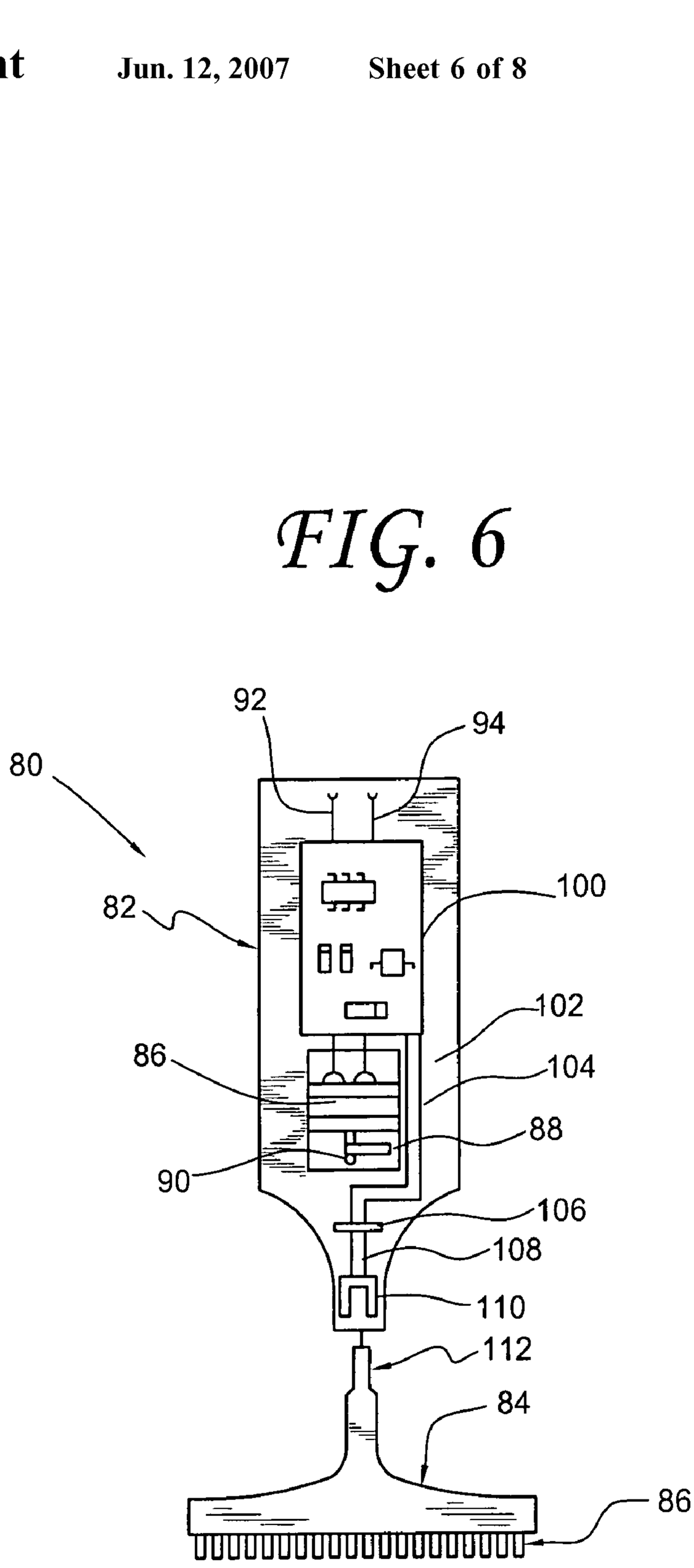
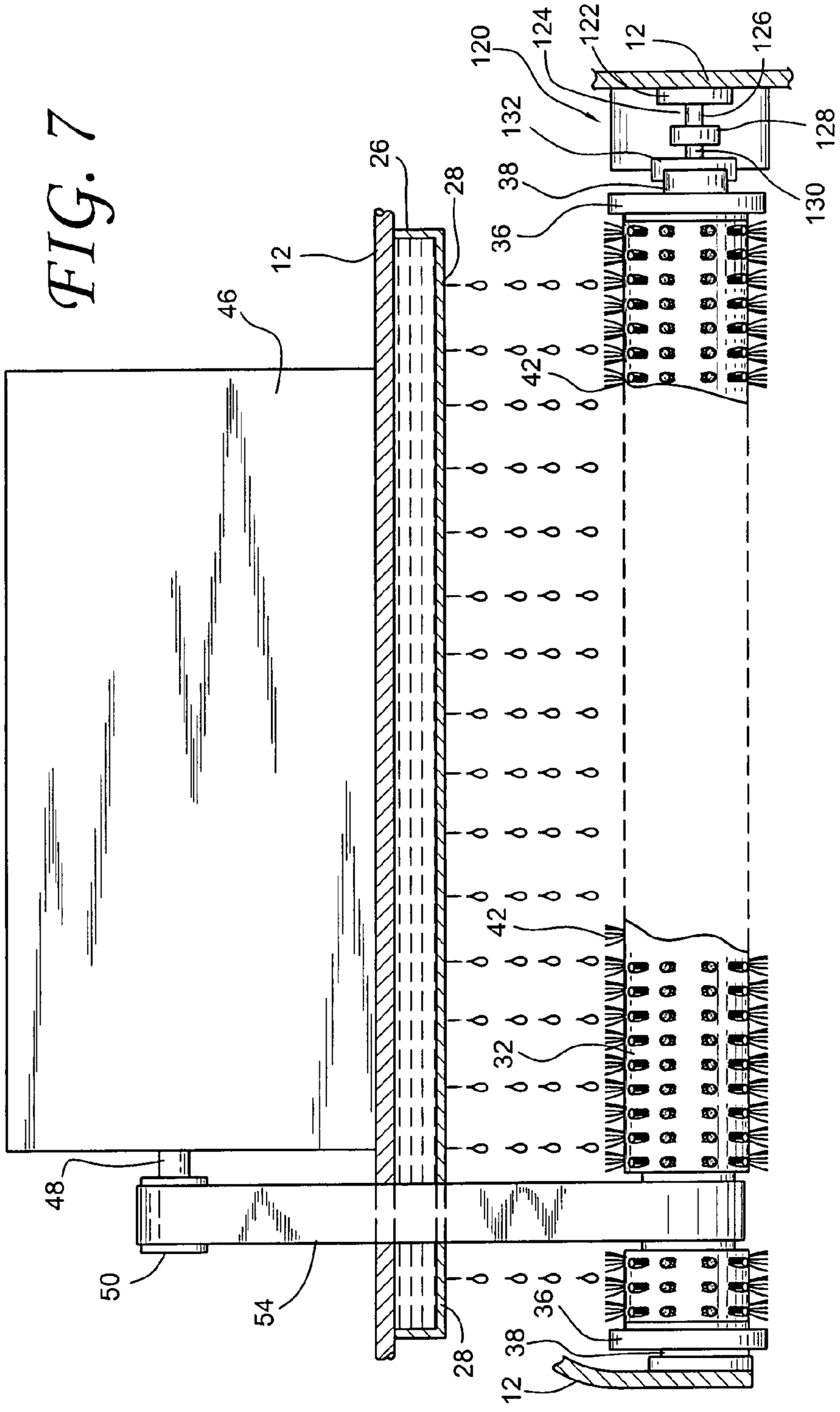


FIG. 7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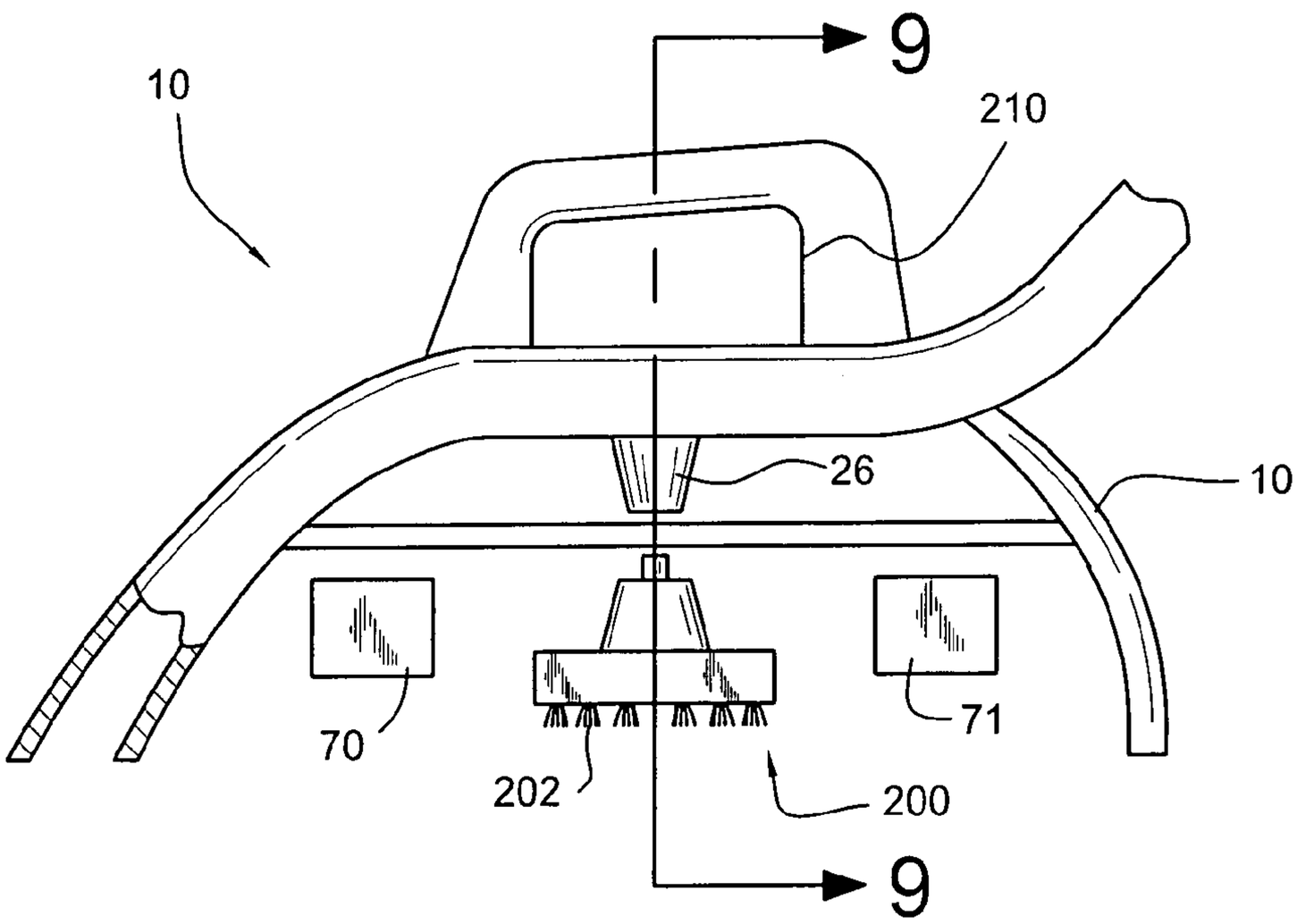

FIG. 8

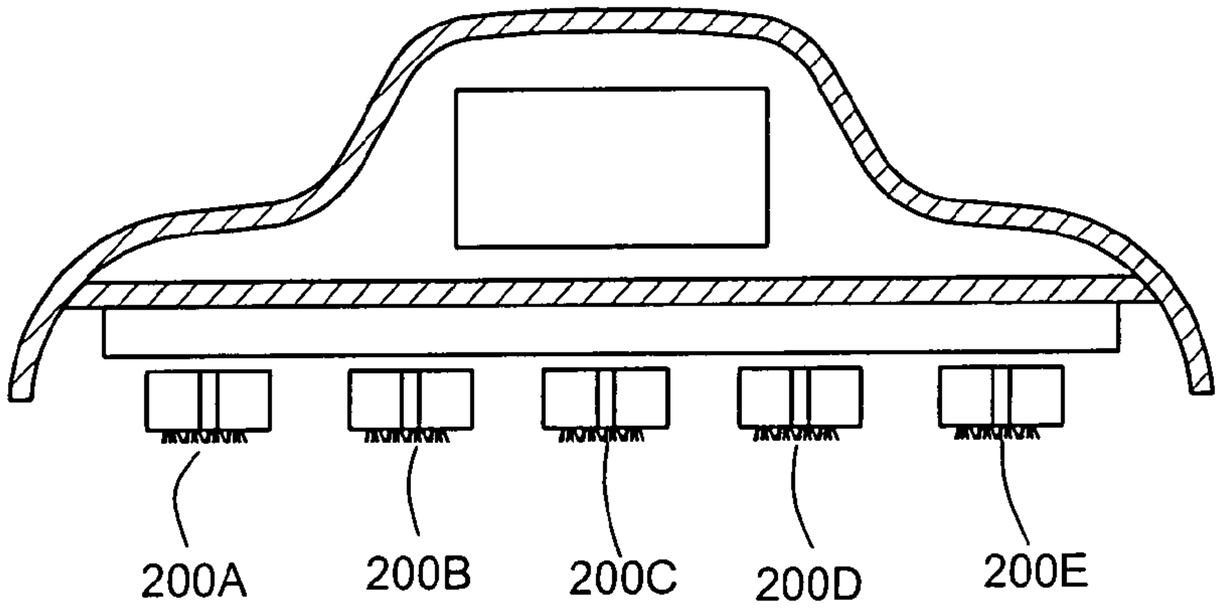

FIG. 9

EXTRACTOR INCLUDING SONIC AGITATOR

FIELD OF THE INVENTION

The present disclosure relates to extractors and, more particularly, to carpet extractors having agitators that assist in dislodging dirt from a surface to be cleaned.

BACKGROUND OF THE INVENTION

Extractors that use a liquid to clean a carpet, upholstery, or like surface are well known in the art. A conventional extractor generally includes a cleaning liquid or diluted detergent delivery system including a container for holding the cleaning liquid, a rotating agitator or a revolving scrubber for scrubbing the surface to be cleaned, and a gravity feed or pump for delivering the cleaning liquid to the surface. The conventional extractor also includes a cleaning liquid recovery system having a recovery nozzle, a suction generating device, such as a motor driven fan, and a dirty cleaning liquid recovery tank. Such extractors are more effective than typical vacuum cleaners due to their ability to loosen ground in dirt by the action of the rotating agitator or scrubbing brush in conjunction with application of the cleaning liquid.

A rotating agitator of an extractor is effective in loosening dirt on the surface of a carpet pile. However, such agitators are not as effective in removing particles embedded deeply in the carpet. Also, rotating agitators tend to push dirt particles down into the carpet, thereby making it more difficult to effectively clean the carpet. Accordingly, there is a need for an agitator construction for an extractor that can provide a more through cleaning action.

SUMMARY OF THE INVENTION

One aspect of this invention is to provide a carpet extractor head that allows a carpet extractor to exhibit an improved cleaning action.

Another aspect of this invention provides a carpet extractor head that allows for an improved cleaning action regardless of the direction in which a user pushes the vacuum cleaner nozzle.

Another aspect of this invention provides a carpet extractor head that thoroughly cleans surface fibers and deep fibers of a carpet by effectively dislodging dirt particles at all depths of the carpet pile.

Another aspect of this invention provides a carpet extractor head including a mechanical agitator that effectively removes imbedded dirt without driving dirt particles deeper into the surface to be cleaned.

A carpet extractor head according to an exemplary embodiment of the invention includes at least one sonic agitator.

A carpet extractor according to an exemplary embodiment of the invention includes a cleaning liquid delivery system that delivers cleaning liquid to a surface to be cleaned, a cleaning liquid recovery system that recovers dirty cleaning liquid and removes loosened dirt particles from the surface to be cleaned, and a carpet extractor head including at least one sonic agitator.

In at least one embodiment of the invention, the carpet extractor head includes at least one mechanical agitator.

In at least one embodiment of the invention, the at least one sonic agitator includes a first sonic agitator and a second sonic agitator, the first sonic agitator being disposed at one side of the at least one mechanical agitator and the second sonic agitator being disposed at another side of the at least one mechanical agitator.

In at least one embodiment of the invention, the sonic agitator includes a speaker.

In at least one embodiment of the invention, the sonic agitator includes an agitating portion and an ultrasonic actuating member that vibrates the agitating portion.

In at least one embodiment of the invention, the mechanical agitator includes a rotatable beater brush.

In at least one embodiment of the invention, the mechanical agitator includes a plurality of rotatable scrub brushes.

These and other features of this invention are described in, or are apparent from, the following detailed description of various exemplary embodiments of this invention.

BRIEF DESCRIPTION OF THE FIGURES

Various exemplary embodiments of the invention will be described in detail, with reference to the following figures, wherein:

FIG. **1** shows an extractor according to an exemplary embodiment of the invention;

FIG. **2** is a side sectional view of an extractor head according to an exemplary embodiment of the invention;

FIG. **3** is a front sectional view of an extractor head according to an exemplary embodiment of the invention;

FIG. **4** is a side sectional view of an extractor head according to another exemplary embodiment of the invention;

FIG. **5** is a side sectional view of an extractor head according to another exemplary embodiment of the invention;

FIG. **6** is a vertical sectional view of a sonic agitator used in the extractor head of FIG. **5**;

FIG. **7** is a front sectional view of an extractor head according to another exemplary embodiment of the invention;

FIG. **8** shows an extractor according to another exemplary embodiment of the invention; and

FIG. **9** is a sectional view taken along the line A–A' of FIG. **8**.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Various exemplary embodiments of the present invention relate to an extractor including at least one sonic agitator. The sonic agitator assists in loosening embedded debris from the surface to be cleaned by working in conjunction with conventional mechanical agitators, such as brush rollers. In at least one exemplary embodiment, ultrasonic actuators are used to rapidly vibrate mechanical agitators to improve the effectiveness of the mechanical agitators in loosening ingrained dirt particles.

In the present disclosure, like reference numbers refer to like elements throughout the drawings, which illustrate various exemplary embodiments of the present invention.

FIG. **1** generally shows an extractor **10** according to an exemplary embodiment of the present invention. The extractor **10** includes an extractor head **11** including a housing **12** supported for movement relative to the surface to be cleaned by a pair of wheels **14**. A handle **16** is mounted to the housing **12** by a hinge assembly (not shown) in a manner

well known in the art. The handle **16** allows for manipulation and control of the extractor **10**.

The housing **12** carries a cleaning liquid delivery system, generally designated by reference numeral **18**, and a cleaning liquid recovery system, generally designated by reference numeral **20**. As shown in FIG. **2**, which is a side sectional view of the extractor head **11**, the cleaning liquid delivery system **18** includes a cleaning liquid supply tank **22** that may, for example, be mounted in the handle **16**. The cleaning liquid may be any suitable cleaning composition known in the art, such as, for example, hot water or a mild detergent solution. Preferably, a pump **24** pumps cleaning liquid from the supply tank **22** to a manifold **26** positioned near the center of an agitator chamber **27** defined by the housing **12**. The pump **24** may include its own electric drive motor or be driven by the agitator motor **46** or the motor of the vacuum fan and motor assembly **58** described below. Alternatively, a gravity feed line can be used instead of the pump **24**.

As shown in FIG. **3**, which is a front sectional view of the extractor head **11**, the manifold **26** includes a longitudinal axis that extends across substantially the entire transverse dimension of the extractor **10**. A series of delivery ports **28** are provided at spaced locations along the length of the manifold **26**. The delivery ports **28** provide a substantially even distribution of cleaning liquid across the width of the extractor as the extractor is pushed over the carpet.

First and second mechanical agitators **32**, **34** are disposed within the housing **12**. In the present embodiment of the invention, the mechanical agitators **32**, **34** are bristle brush rollers mounted for relative rotation with respect to the housing **12**. Any style of bristle pattern may be used and the bristles **42** themselves may be directly tufted or inserted into each mechanical agitator **32**, **34** or even carried by means of a replaceable strip attached to the body of each agitator **32**, **34**. Any other suitable mechanical agitator structure may be used, such as, for example, resilient wiper blades or a series of resilient projecting elastomeric fingers.

The mechanical agitators **32**, **34** in the form of bristle brush rollers may be mounted in any manner well known to those skilled in the art. For example, each mechanical agitator **32**, **34** may rotate on a shaft (not shown) bridging between and supported by bearings held by a pair of end caps **36**. Each end cap **36** carries a lug **38** that is received in a mating slot in the housing **12**. The mechanical agitators **32**, **34** may be driven by a drive motor **46** mounted to the housing **12**. The drive motor **46** includes a drive shaft **48** connected to a drive pulley **50**. A drive belt **54** connects the drive pulley **50** to an idler pulley **52** and the first and second mechanical agitators **32**, **34**. The idler pulley **52** is carries for relative rotation by stub shaft **53** fixed to the housing **12**. As shown in FIG. **2**, drive belt **54** extends around the idler pulley **52** over the top of the second mechanical agitator **34** and around the bottom of the first mechanical agitator **32** before returning to the drive pulley **50**. Thus, as the motor **46** is driven in the clockwise direction, the first and second mechanical agitators **32**, **34** are driven in counterrotating directions.

The cleaning liquid recovery system **20** includes a recovery nozzle **56** carried at the front of the housing **12** adjacent to the first mechanical agitator **32**. The first mechanical agitator **32** is rotated in a direction toward the recovery nozzle **56**, which aids in the efficient recovery and extraction of cleaning liquid and associated entrained dirt and soil from the carpet being cleaned.

The nozzle **56** is in communication with a vacuum generator such as a fan and motor assembly **58** carried in the housing. More specifically, cleaning liquid and entrained soil and dirt are extracted from the carpet being cleaned and drawn through the nozzle **56** by the fan and motor assembly **58** to a dirty liquid recovery tank **60**. This recovery tank **60** is equipped with any of a number of filtering systems of a type well known in the art for separating the air from the cleaning liquid whereby the cleaning liquid is trapped and maintained in the recovery tank **60** and the air is exhausted into the environment.

In addition to the mechanical agitators **32**, **34**, a sonic agitator generally designated by reference numeral **70** is disposed in the housing **12**. Although the sonic agitator **70** is shown attached to the housing **12** in front of the mechanical agitators **32**, **34**, it should be appreciated that the sonic agitator **70** can be disposed behind the mechanical agitators **32**, **34**. Further, as shown in FIG. **4**, which is a side sectional view of an extractor head according to another exemplary embodiment of the invention, a sonic agitator **70** may be disposed at the front of the mechanical agitators **32**, **34** and another sonic agitator **71** may be disposed behind the mechanical agitators **32**, **34**. As will be come more apparent below, such an arrangement of sonic agitators will allow the extractor **10** to effectively loosen and suck up embedded dirt regardless of the direction of movement of the housing **12**. The sonic agitator **70** may be any suitable agitator that effectively vibrates the surface to be cleaned without substantially contacting the surface, so that ground-in dirt can be dislodged without driving the dirt deeper into the carpet pile.

The sonic agitator **70** in the present embodiment of the invention is a speaker **72**. The speaker **72** is preferably housed in and attached to the housing **12** by a speaker housing **74**. The speaker housing **74** is preferably made of an acoustically transparent material substantially impervious to dirt and fluid so as to seal speaker **72** from the debris sucked up by the extractor **10**. The speaker housing may be made of, for example, polypropylene. Speaker **72** is preferably a solid state power circuit including a frequency generator and an amplifier capable of producing up to, for example, 100 watts of power. The speaker **72** may be tuned to emit sound waves at a frequency in a range of about 200 hertz to about 500 hertz. Within such a frequency range, the speaker **72** will be effective in loosening dirt embedded within carpet and also within hard surfaces, such as wood or tile flooring.

The speaker **72** may include amplitude and/or frequency control knobs disposed at a location that is accessible to a user, such as on the top of the housing **12**. The user may then have the ability to adjust the amplitude and/or frequency of the speaker **72** to a level at which the extractor **10** is most effective in loosening ground in dirt.

It should be appreciated that the sonic agitator **70** is not limited to a speaker-type system. For example, FIG. **5** shows a side sectional view of an extractor head **11** in which the sonic agitator **70** is in the form of a sonic beater that contacts and vibrates the surface to be cleaned at a rapid rate to pre-loosen ground in dirt so as to enhance the effectiveness of the first and second agitators **32**, **34**. The sonic beater **80** includes an ultrasonic actuating member **82** and a brush head **84**. As shown more clearly in FIG. **6**, which is a vertical sectional view of the sonic beater **80**, the brush head **84** includes a bristled end **86**. The brush head **84** is set at a predetermined level so that the bristled end **86** will barely contact the surface to be cleaned while extractor **10** is in operation. The ultrasonic actuating member **82** includes an electric motor **86** to which is attached an eccentrically mounted member **88** via a rotatable shaft **90**. The electric motor **86** is connected to a power source (not shown) via

electrical conductors **92** and **94**. When the extractor **10** is turned on, the electric motor **86** will rotate eccentric member **88** and the entire sonic beater **80** will vibrate in a rotary direction. Because the ultrasonic actuating member **82** is fixed to the extractor head **11** and the mass of the ultrasonic actuating member **82** is much greater than that of the brush head **84**, the bristled end **86** of the brush head **84** will vibrate about a greater radius than that of the ultrasonic actuating member **82**. Thus, the bristled end **86** will rotate at a rapid rate.

Also connected to the power source is an electronic circuit package **100** that produces high frequency oscillations which are coupled via lines **102** and **104** to an ultrasonic transducer **106**. The transducer **106** is in turn mechanically coupled via connector **108** to a holder **110** which is adapted to surround and frictionally secure within it an extension **112** of the brush head **84**. The ultrasonic transducer **106** is preferably a commercially available device capable of producing an ultrasonic wave in the frequency range of, for example, 10–20 MHz. The energy is coupled directly from the transducer **106** through the connector **108** which acts as a wave guide and into holder **110** from which it propagates into the brush head **84**. Thus, the bristled end **86** of the brush head **84** vibrates ultrasonically while being caused to rotate by the rotating eccentric member **88**. This rapid motion of the brush head **84** sonically agitates the dirt embedded in the surface to be cleaned, and therefore pre-loosens the dirt before the agitators **32**, **34** pass over the surface. Also, because the bristled end **86** of the brush head **84** barely contacts the surface, the brush head **86** is able to agitate the dirt without grounding the dirt into the carpet.

FIG. **7** shows a front sectional view of an extractor head according to another exemplary embodiment of the invention. The present embodiment of the invention is substantially the same as the previous embodiment except that the sonic agitation used to loosen embedded dirt is caused by rapidly vibrating the agitators **32**, **34**, rather than by using a separate sonic agitator, such as the speaker **72** or the sonic beater **80**. As in the previous embodiment, the extractor head **11** generally includes a cleaning liquid delivery system **18** and a cleaning liquid recovery system **20**. First and second agitators **32**, **34** are disposed within the housing **12**. In the present embodiment of the invention, the agitators **32**, **34** are bristle brush rollers mounted for relative rotation with respect to the housing **12**. Any style of bristle pattern may be used and the bristles **42** themselves may be directly tufted or inserted into each agitator **32**, **34** or even carried by means of a replaceable strip attached to the body of each agitator **32**, **34**.

As in the previous embodiment, each agitator **32**, **34** may rotate on a shaft (not shown) bridging between and supported by bearings held by a pair of end caps **36**. As described in further detail below, the end cap **36** of at least one of the agitators **32**, **34** carries a lug **38** that is received in a mating holder of an ultrasonic actuator **120** carried by the housing **12**. The agitators **32**, **34** may be driven by a drive motor **46** mounted to the housing **12**. The drive motor **46** includes a drive shaft **48** connected to a drive pulley **50**. A drive belt **54** connects the drive pulley **50** to an idler pulley **52** and the first and second agitators **32**, **34**. The idler pulley **52** is carries for relative rotation by stub shaft **53** fixed to the housing **12**. As shown in FIG. **2**, drive belt **54** extends around the idler pulley **52** over the top of the second agitator **34** and around the bottom of the first agitator **32** before returning to the drive pulley **50**. Thus, as the motor **46** is driven in the clockwise direction, the first and second agitators **32**, **34** are driven in counterrotating directions.

The ultrasonic actuator **120** is mounted to the housing **12** and is operatively engaged with the shaft of the first agitator **32** via the lug **38**. The ultrasonic actuator **120** includes an electronic circuit package **122** that produces high frequency oscillations which are coupled via lines **124** and **126** to an ultrasonic transducer **128**. The transducer **128** in turn is mechanically coupled via connector **130** to a holder **132** which is adapted to surround and frictionally secure within it the lug **38**. Thus, the ultrasonic waves caused by the transducer **128** are imparted to the lug **38**, which in turn causes the first agitator **32** to rapidly vibrate while rolling over the surface to be cleaned. This enhances the effectiveness of the first agitator **32** by allowing it to agitate and loosen embedded dirt without pushing the dirt further into the carpet.

It should be appreciated that both the first and second agitators **32**, **34** may be operatively connected with a corresponding ultrasonic actuator, so that both agitators **32**, **34** are able to rapidly vibrate while rolling across a surface. Also, the extractor head **11** may include a sonic agitator **70** disposed in the housing **12** in addition to the ultrasonic actuator **120** to improve the effectiveness of the extractor **10** in loosening and removing embedded dirt particles. For example, in other exemplary embodiments of the invention, the speaker **72** and/or the sonic beater **80** may be used in conjunction with the ultrasonic actuator **120**.

FIG. **8** is a side sectional view of an extractor head according to another exemplary embodiment of the invention, and FIG. **9** is a sectional view taken along the line A–A' of FIG. **8**. The extractor head according to the present embodiment is essentially the same as the embodiment shown in FIG. **4** except that the mechanical agitators are round scrub brushes. Specifically, the extractor **10** according to the present embodiment of the invention includes a scrub brush assembly **200** suspended in the housing **12**. Scrub brush assembly includes a plurality of scrub brushes **200**A–**22**E that extend across the bottom of the housing **12** of the extractor **10**. A plurality of bristles **202** is disposed around the bottom of each of the scrub brushes **200**A–**200**E. The scrub brushes **200**A–**200**E are driven so as to rotate as the extractor **10** is pushed across a surface to be cleaned. Any suitable drive means known in the art may be used to drive the scrub brushes **200**A–**200**E, such as, for example, an air driven turbine **210** through a suitable gear drive train or transmission (not shown). The scrub brushes **200**A–**200**E may all be driven in the same direction, or they may be alternately driven in clockwise and counter-clockwise directions to enhance the scrubbing action. A manifold **26** delivers cleaning liquid to each of the scrub brushes **200**A–**200**E and the cleaning liquid is released onto the carpet surface through openings **204**A–**204**E at the bottom of the scrub brushes **200**A–**200**E.

As in previous embodiments of the invention, a sonic agitator may be disposed at both or either side of the scrub brush. For example, FIG. **8** shows a first sonic agitator **70** disposed at one side of the scrub brush assembly **200** and a second sonic agitator **71** disposed at another side of the scrub brush assembly **200**. The first and second sonic agitators **70**, **71** may be any of the sonic agitators previous described, such as a speaker or a sonic beater, or any other known or later discovered sonic agitator. Alternatively, each of the scrub brushes **200**A–**200**E may be actuated to sonically vibrate as they rotate, so that separate sonic agitators are not needed.

It should be appreciated that the present invention is intended to encompass any combination of mechanical and sonic agitators in an extractor head of a carpet extractor,

where the mechanical agitators and/or the sonic agitators are caused to sonically agitate the surface to be cleaned. The present invention is intended to also encompass extractors that do not include mechanical agitators, but instead use suction action in conjunction with one or more sonic actuators to loosen and remove dirt. Such extractors would have little or no agitator contact with the surface to be cleaned, which may be advantageous when cleaning delicate surfaces, such as antique rugs.

While the foregoing invention has been described in some detail for purposes of clarity and understanding, it will be appreciated by one skilled in the art from a reading of the disclosure that various changes in form and detail can be made without departing from the true scope of the invention in the appended claims.

What is claimed is:

1. A carpet extractor head comprising at least one sonic agitator and at least one mechanical agitator, the at least one mechanical agitator comprising a rotatable brush roller and a sonic agitator that vibrates the rotatable brush roller.

2. The carpet extractor head of claim **1** wherein the at least one sonic agitator comprises a first sonic agitator and a second sonic agitator, the first sonic agitator being disposed at one side of the at least one mechanical agitator and the second agitator being disposed at another side of the at least one mechanical agitator.

3. The carpet extractor head of claim **1**, further comprising a housing that houses the at lease one sonic agitator.

4. The carpet extractor head of claim **1**, wherein the at least one sonic agitator comprises a speaker.

5. The carpet extractor head of claim **1**, wherein the at least one sonic agitator comprises:

an agitating portion; and

an ultrasonic actuating member that rotates and vibrates the agitating portion.

6. The carpet extractor head of claim **5**, wherein the agitating portion is a brush head.

7. The carpet extractor head of claim **5**, wherein the ultrasonic actuating member comprises an ultrasonic transducer.

8. The carpet extractor head of claim **1**, further comprising a manifold that delivers cleaning liquid to a surface to be cleaned.

9. A carpet extractor comprising the carpet extractor head of claim **1**.

10. A carpet extractor comprising:

a cleaning liquid delivery system that delivers cleaning liquid to a surface to be cleaned;

a cleaning liquid recovery system that recovers dirty cleaning liquid and removes loosened dirt particles from the surface to be cleaned; and

a carpet extractor head comprising at least one sonic agitator and at least one mechanical agitator, the at least one mechanical agitator comprising a rotatable brush roller and a sonic agitator that vibrates the rotatable brush roller.

11. The carpet extractor of claim **10**, wherein the cleaning liquid delivery system comprises:

a cleaning liquid supply tank;

a manifold disposed in the carpet extractor head that distributes cleaning liquid to the surface to be cleaned; and

a pump that delivers cleaning liquid from the cleaning liquid supply tank to the manifold.

12. The carpet extractor head of claim **10**, wherein the cleaning liquid recovery system comprises:

a dirty liquid recovery tank disposed in the carpet extractor head; and

a recovery nozzle in the carpet extractor head that delivers dirty liquid and dirt particles to the dirty liquid recovery tank.

13. The carpet extractor of claim **10**, wherein the at least one sonic agitator comprises a first sonic agitator and a second sonic agitator, the first sonic agitator being disposed at one side of the at least one mechanical agitator and the second agitator being disposed at another side of the at least one mechanical agitator.

14. The carpet extractor of claim **10**, wherein the at least one sonic agitator comprises a speaker.

15. The carpet extractor of claim **10**, wherein the at least one sonic agitator comprises:

an agitating portion; and

an ultrasonic actuating member that rotates and vibrates the agitating portion.

16. The carpet extractor of claim **15**, wherein the agitating portion is a brush head.

17. The carpet extractor of claim **15**, wherein the ultrasonic actuating member comprises an ultrasonic transducer.

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